HP Apollo 8000 System Site Preparation Guide

Abstract

This document provides site preparation guidance for the HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack.

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Overview

This section provides an overview of the HP Apollo 8000 System. Throughout this section, the various specifications and aspects of the system are defined as thoroughly as possible so that all data is considered for a successful site preparation.

Product overview

The HP Apollo 8000 System is a high-density, energy-efficient, sustainable high-performance computing solution that uses an innovative warm-liquid cooling technology to fuel the future of supercomputing. It offers hundreds of teraflops per rack to accelerate results, with a modular, rack-based system that is easy to install, maintain, and monitor. Your customers can even recycle hot water "waste heat" to heat their data center efficiently.

The HP Apollo 8000 System comprises the following components:

- One or more HP Apollo 8000 iCDU Racks and their associated onboard iCDU control system
- One or more HP Apollo f8000 Racks and their associated control system
- Primary plumbing interface assembly kit that connects the individual iCDUs to the facility water system
- Secondary plumbing system that connects the individual iCDUs to the HP Apollo f8000 Racks. This secondary closed loop system provides cooling for the HP Apollo f8000 Rack and isolates the HP Apollo f8000 Rack from untreated, potentially incompatible primary water.
- Drain and leak detection system

The iCDU performs the following functions:

- Accepts water supplied from the facility water system
- Returns heated water back to the facility water system
- Supplies cooled water to the HP Apollo f8000 Racks through the secondary plumbing system
- Accepts heated water returned from the HP Apollo f8000 Racks
- Maintains the preset water temperature and pressure in the secondary plumbing system
- Monitors system health
- Isolates primary and secondary water in case of a leak

For more information, see "Advantages of a dedicated secondary loop system (on page 23)."

Example configurations

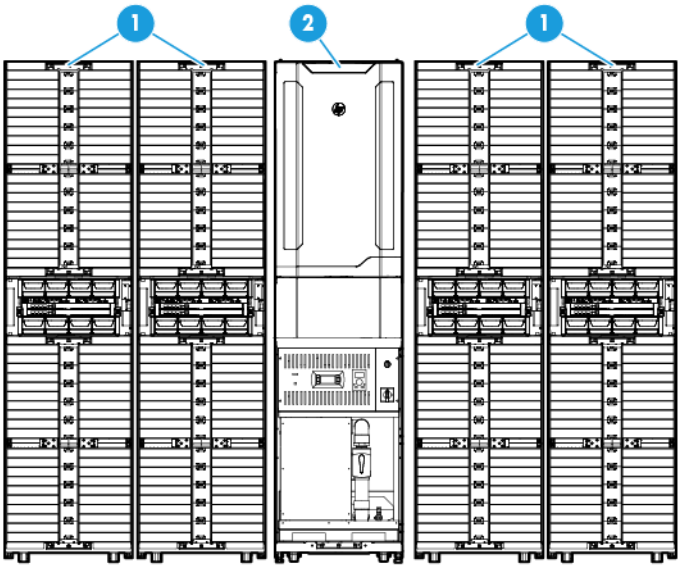
The HP Apollo 8000 System is a self-contained IT product integrated with a closed-loop cooling system that offers two configuration options.

The following figures demonstrate examples of the HP Apollo f8000 Rack (1) to iCDU (2) ratio. The doors are removed for clarity.

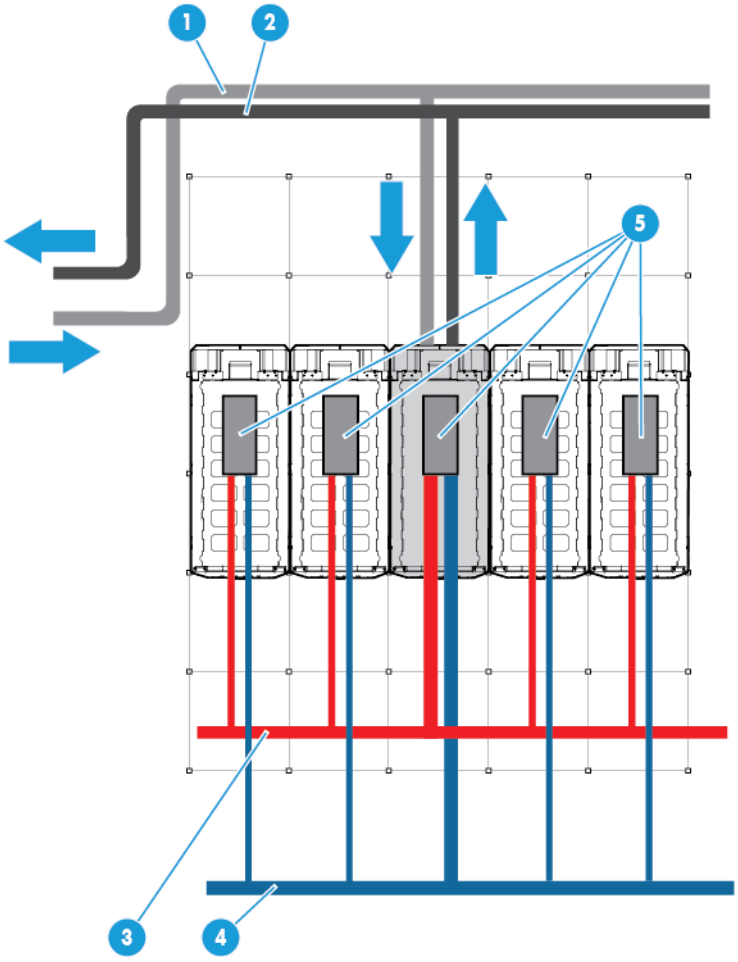
△ **CAUTION:** To reduce the risk of condensation and avoid damage to the equipment when operating with chilled water, keep the rack doors closed during operation.

Example single iCDU configuration (with up to four HP Apollo f8000 Racks)

- Front view



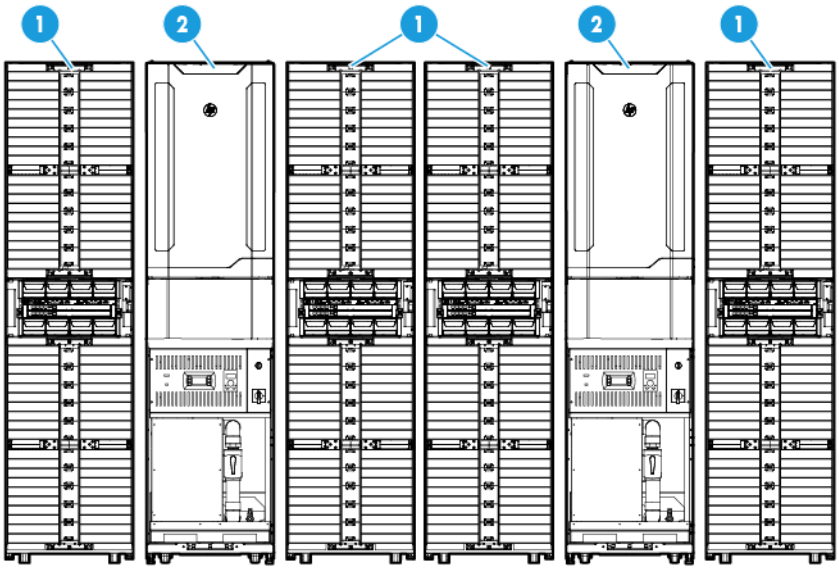
- Top view



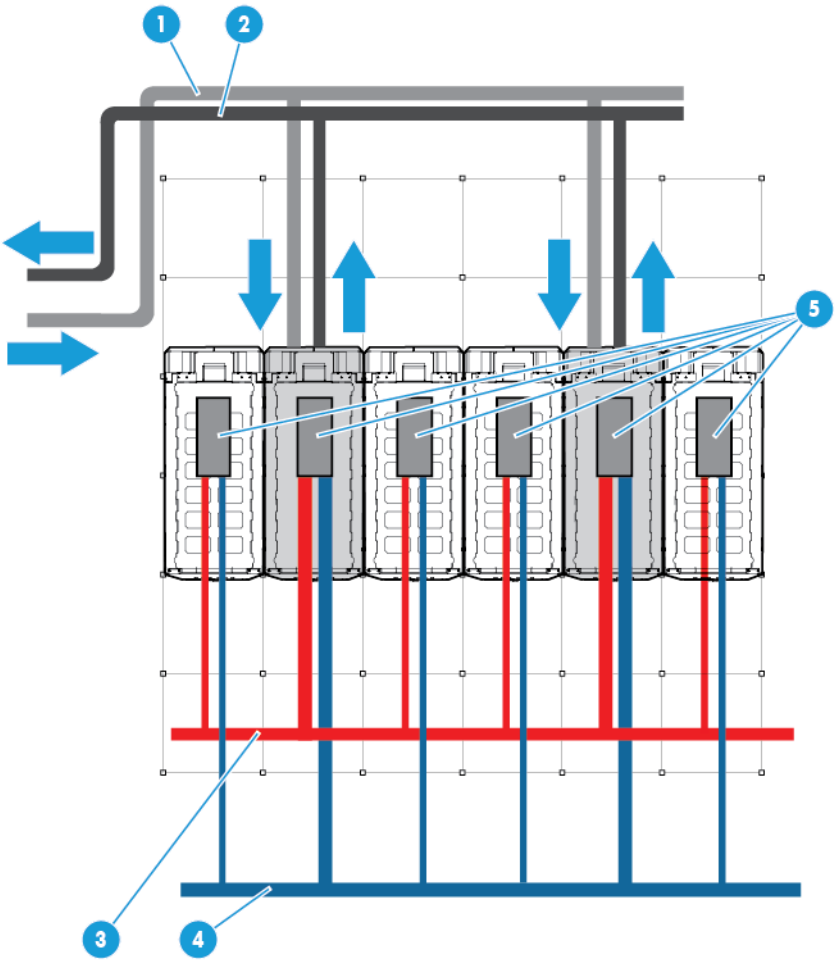
Item	Description
1	Facility water in
2	Facility water out
3	Secondary water out
4	Secondary water in
5	Heat exchanger

Example redundant iCDU configuration (with up to four HP Apollo f8000 Racks)

- Front view



- Top view



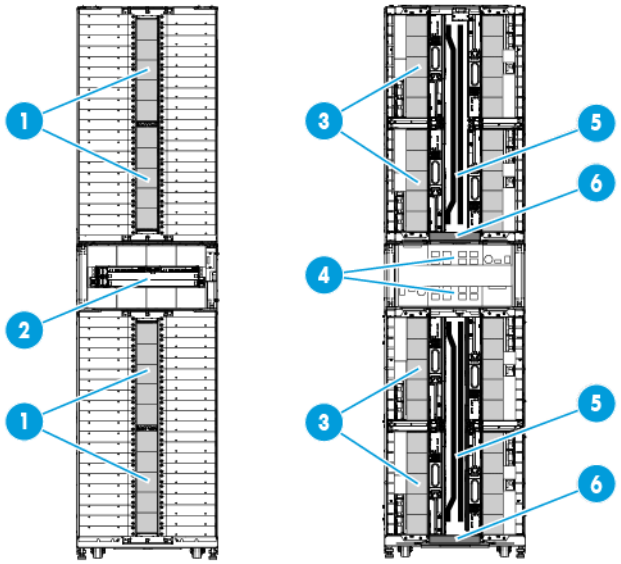
Item	Description
1	Facility water in
2	Facility water out
3	Secondary water out
4	Secondary water in
5	Heat exchanger

The iCDU transfers heat to the facility water plant and has a secondary loop that provides cooling to the servers in the IT racks.

Key components

The HP Apollo 8000 System is composed of several key components, described below, which all work together to provide a modular, rack-based, cooling solution.

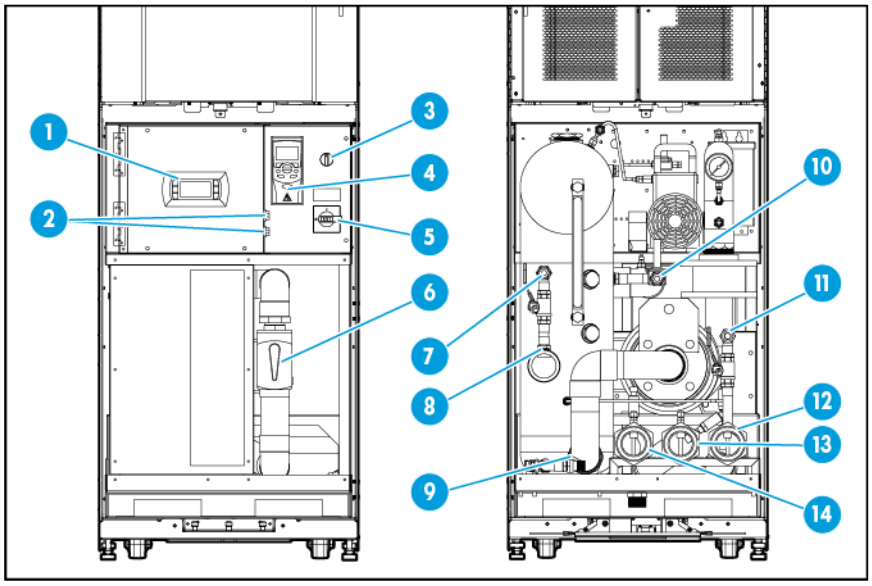
HP Apollo f8000 Rack front and rear components



Item	Description	Purpose
1	Front fans	Provide circulation of cooled air through the rack by pulling the warm air over the heat exchanger coils
2	HP APM module*	Provides a point of contact for server rack components, node identification, and logging
3	Rear fans	Provide circulation of cooled air through the rack by pulling the cooled air through the IT equipment
4	Power supplies	Provides power to the backplanes
5	Rack piping	Allows flow of cool water into the rack and heated water out of the rack
6	Drain pans	Collect water condensation, removed through the gravity drain

*For more information about the HP APM module, see the *HP APM User Guide* on the HP website (http://www.hp.com/support/APM_UG_en).

HP Apollo 8000 iCDU Rack front and rear components



Item	Description	Purpose
1	Display panel	Provides general cooling unit status
2	External communication connections	Provides connection to external components and networks
3	Control switch	Allows override of pump control for maintenance and testing
4	VFD display	Displays pump frequency
5	Power switch	Controls main power to the iCDU
6	Two-way facility water control valve	Electro-mechanical valve that controls flow of facility water
7	iCDU local HEX return, 3/4 female hose bibb	Secondary water that stays local to the iCDU
8	Water inlet 2-1/2" male cam-lock	Secondary water in
9	iCDU drain, 3/4 male hose bibb	Used to drain the iCDU
10	Secondary water inlet, 3/4 female hose bibb	Secondary water system fill
11	iCDU local HEX supply, 3/4 male hose bibb	Secondary water that stays local to the iCDU
12	Water outlet 2-1/2" male cam-lock	Secondary water out
13	Water inlet 2-1/2" male cam-lock	Facility water in
14	Water outlet 2-1/2" male cam-lock	Facility water out

Physical specifications

The table below lists the approximate physical specifications of a single HP Apollo f8000 Rack or HP Apollo 8000 iCDU Rack as received from the factory. For help in calculating the total weight of the rack, including components, see "Floor loading considerations (on page 18)."

HP Apollo f8000 Rack

Parameter	Packaged system (as shipped on pallet)	Unpackaged system (off pallet, unwrapped)
Height	2575 mm (102 in)	2382 mm (94 in)
Width	1016 mm (40 in)	607 mm (24 in)
Depth	1676 mm (66 in)	1427 mm (57 in)
Weight	1322 kg (2914 lb)*	1225 kg (2700 lb)**
Height top assembly	1253 mm (50 in)	1060 mm (42 in)
Height mid and bottom assembly	1555 mm (62 in)	1362 mm (54 in)
Weight top assembly	Up to 510 kg (1124 lb)*	Up to 413 kg (910 lb)**
Weight mid and bottom assembly	790 kg (1742 lb)*	693 kg (1528 lb)**

*Weight for a completely packaged system with no server trays installed
**Weight for an unpackaged system with no server trays installed

HP Apollo 8000 iCDU Rack

Parameter	Packaged system (as shipped on pallet)	Unpackaged system (off pallet, unwrapped)
Height	2575 mm (102 in)	2382 mm (94 in)
Width	1016 mm (40 in)	607 mm (24 in)
Depth	1676 mm (66 in)	1427 mm (57 in)
Weight	993 kg (2188 lb)*	896 kg (1974 lb)**
Height top assembly	1253 mm (50 in)	1060 mm (42 in)
Height mid and bottom assembly	1555 mm (62 in)	1362 mm (54 in)
Weight top assembly	370 kg (814 lb)*	273 kg (600 lb)**
Weight mid and bottom assembly	720 kg (1588 lb)*	624 kg (1374 lb)**

*Weight for a completely packaged system with no hose kits or IT equipment installed
**Weight for an unpackaged system with no hose kits or IT equipment installed

Electrical specifications

The following table lists the electrical specifications for the HP Apollo f8000 Rack.

Parameter	Value	Comments
Operating Voltage Minimum Maximum	220/380VAC, 3 phase with N + PE 277/480VAC, 3 phase with N + PE	There are two styles of input power meters: • North American—Supports 480VAC • International—Supports 380VAC to 415VAC
AC line frequency	50/60 Hz	—
AC line phase	Three	True 3-phase input power conversion for inherent phase current balancing

Parameter	Value	Comments
Rated input current	• 380VAC source—415VAC 32A per input meter • 480VAC source— 24A per input meter	Per line cord, two cords per power shelf, two shelves per IT rack
Maximum inrush current	Less than 2 times the peak full load current at any line condition	Per line cord
Dropout/hold-up time at minimum line voltage	20 ms	—
Circuit breaker rating	• 380-415VAC source —32A • 480VAC source—30A	Per cord
Power factor	> 0.98	At all loads above 20%
Ground leakage current	<3.0mA	Per cord
Maximum power consumption (full IT rack)	79,775W capable power shelf	This is the maximum power at the input of the HVDC power shelves. There are two power shelves per rack, each with dual 3-phase AC feeds.
Power cords (included with power shelves)	220/380 -240/415VAC 277/480VAC	3 meter, 8AWG, 5-wire with IEC 60309-32 plug 3 meter, 8AWG, 5-wire with NEMA L22-30P plug

The following table lists the electrical specifications for the HP Apollo 8000 iCDU Rack.

Parameter	Value	Comments
Operating Voltage Minimum Maximum	220/380VAC, 3 phase with N + PE 288/480VAC, 3 phase with N + PE	There are two CDU versions: • North American—Supports 480VAC • International—Supports 380VAC to 415VAC
AC line frequency	50/60 Hz	—
AC line phase	Three phase	—
Rated input current	• 480VAC source—7.1 A • 380VAC to 415VAC source—9.5 A	Per line cord
Maximum inrush current	580 A peak-to-peak available	Per line cord
Circuit breaker rating	15 A	Per cord
Power factor	Typical value = 0.80	At all loads
Maximum power consumption	5.7 kVA	Steady state
Power cords	30A	• 480VAC source—NEMA L22-30P watertight connector • 380VAC to 415VAC source—IEC 60309 watertight connector

Facility planning for implementation

Planning overview

An approach to water supply and design should take into consideration short- and long-term needs for cooling. Immediate supply needs should meet the specifications and target cooling requirements based on the parameters defined in this site planning guide. In anticipation of future heat loads, dedicated loop facility water piping should be designed and installed based on specific cooling load increments (such as 80 kW), the specific number of racks per row or loop, and other site build-out planning parameters. As cooling, rack space, and equipment density requirements increase, additional racks can be connected into the facility water system. The facility water piping system can be installed under the floor or above the rack.

Installation service for the HP Apollo f8000 Rack and iCDU is available for order.

This section discusses key issues for site preparedness, including:

- Space considerations (for delivery, operation, and service) and other related considerations (such as floor loading)
- Electrical considerations
- Coolant source options and quality considerations
- Other considerations

A complete site preparation checklist is provided in "Appendix A: Forms and checklists (on page 35)."

Space and positioning considerations

The HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack are larger (and, when fully populated, heavier) than a standard 0.48 m (19 in) equipment rack. Therefore, space required for maneuvering, operating, and servicing the HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack is greater than for standard-sized racks.

Delivery space requirements

NOTE: Due to individual facility sites and product configurations, consult your representative to ensure appropriate clearances, specifications, and other product installation requirements.

It is important to ensure the facility has adequate space to receive and remove the HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack from the shipping pallet.

Consider the following when unloading the racks:

- Delivery plans should include the possible removal of facility walls or door.
- The packaged dimensions of the HP Apollo f8000 Rack or HP Apollo 8000 iCDU Rack (including shock pallet and cartons) are approximately 2575 mm (102 in) height x 1016 mm (40 in) width x 1676 mm (66 in) depth.

  In some instances the HP Apollo f8000 Racks are shipped in two sections. The height of the two separate sections (including shock pallet and cartons) would be approximately 1253 mm (50 in) and

1555 mm (62 in). There must be adequate space to stack the top section on the bottom section, independent of the lifting equipment space. Allow up to 2108 mm (83 in) to ensure clearance.

Be sure to consider allowances for the pallet jack or other lifting and movement equipment.

Maneuvering space requirements

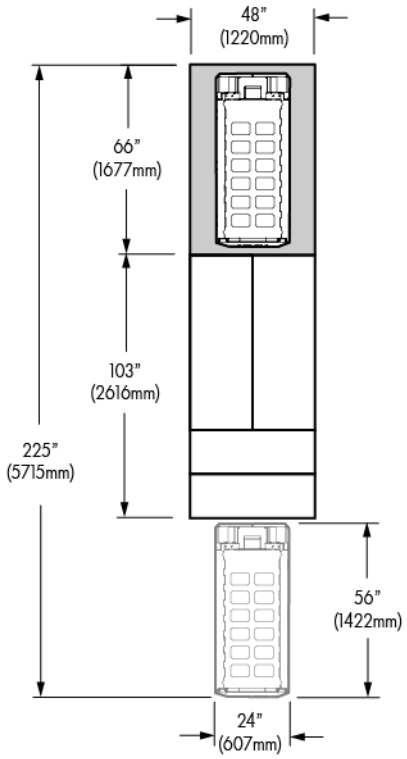
⚠ **WARNING:** To reduce the risk of personal injury or damage to the equipment, do not attempt to move equipment racks alone. Obtain adequate assistance to stabilize the rack during movement, or hire professional equipment riggers.

⚠ **WARNING:** To reduce the risk of personal injury or damage to the equipment, use extreme care when moving racks with casters. Sudden stops, excessive force, and uneven surfaces can cause the product to overturn.

When maneuvering the HP Apollo f8000 Rack or HP Apollo 8000 iCDU Rack, use the following guidelines:

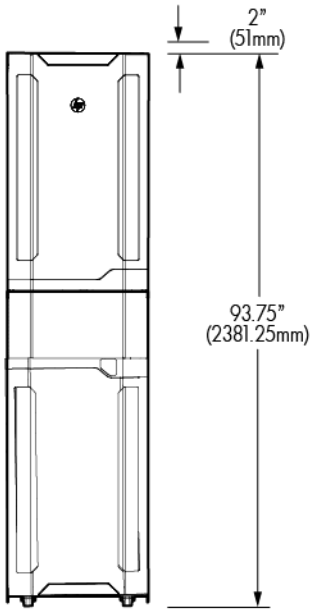
- Racks with casters should be moved with care. The HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack are equipped with all swivel casters. Sudden stops, excessive force, and uneven surfaces can cause the product to overturn.
- When rolling the rack, make sure to push firmly on the front door frame edges.
- Ensure there is a room and door large enough to accommodate the movement of the rack into the data center.
- Be sure elevators have adequate load capacity, floor space, and door clearance to accommodate the rack when transporting it to an upper or lower building floor.
- Be sure that doorway thresholds are adequate to accommodate the rack when transporting within a building. Threshold gaps and openings might require a threshold transition to ensure smooth movement of rack casters.

The following figure shows the maneuvering space required when unloading the HP Apollo f8000 Rack or HP Apollo 8000 iCDU Rack from a pallet. Use the delivery forms provided in "Appendix A: Forms and checklists (on page 35)" when planning for unit maneuvering.

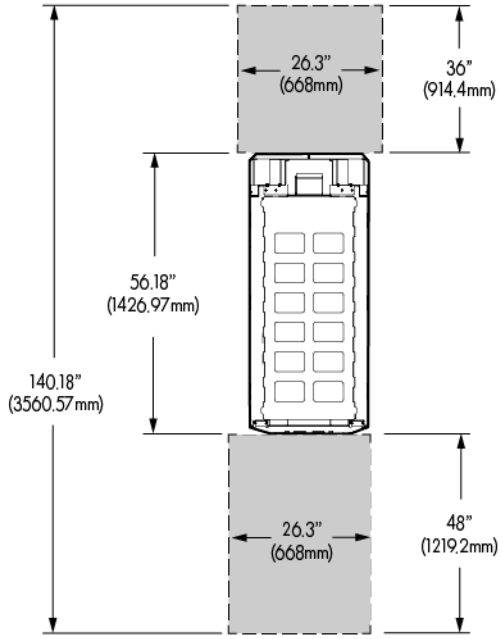


Operational space requirements

The total height is approximately 2382 mm (94 in). However, once the rack is in place, the front of the rack is slightly elevated to allow for gravity to drain water towards the rear of the rack. An additional 51 mm (2 in) of clearance is recommended above the rack to account for adjusting the rack leveling feet (on page 16).

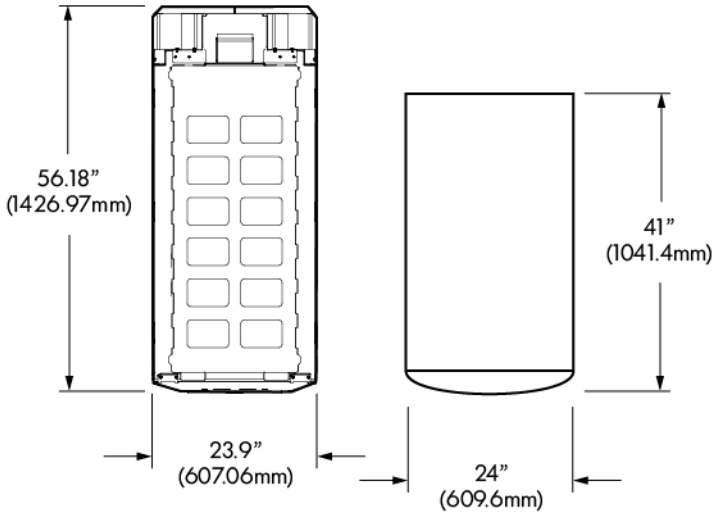


The recommended minimum amount of access space for the rack is 1,219 mm (48 in) in the front and 914 mm (36 in) in the rear. Additional clearance is required for accessing and servicing IT equipment.



System positioning

The HP Apollo f8000 Rack or HP Apollo 8000 iCDU Rack can be installed next to an existing or new row of HP 10000 Series or HP 11000 Series racks. The racks must be arranged in a flush front configuration.



Be aware of the potential for slight rear door swing interference when arranging the HP Apollo f8000 Rack or HP Apollo 8000 iCDU Rack next to an HP 10000 Series or HP 11000 Series rack, depending on the configuration. Equipment might require the removal of a door during installation for full, unimpeded access.

Rack leveling feet

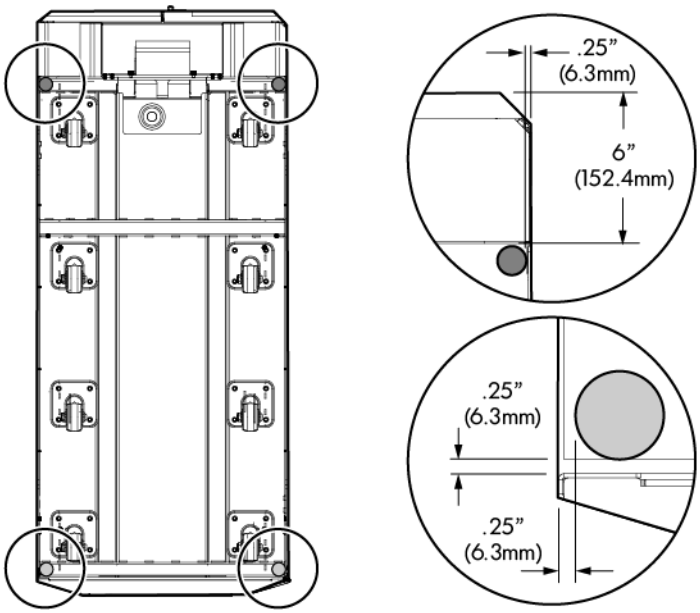
⚠ **WARNING:** Static loading limits cannot be achieved if the rack is not on its leveling feet or is rolled or pushed from its position. Your floor weight capacity might not support the full static load capacity. Check with your floor provider before loading. HP is not responsible for floor damages due to floor overloading.

⚠ **CAUTION:** To reduce the risk of damage to the casters, make sure that the full weight of the rack rests on the leveling feet and feet pads, and not on the casters. The casters are designed only as an aid in moving the rack into position. They are not designed to support the weight of the rack, and the casters may become damaged if relied on to support the rack.

The HP Apollo 8000 System includes leveling feet and does not require fastening to the floor. Care should be taken during the loading of the equipment to ensure the rack remains stable during operation and servicing to avoid personnel and equipment damage. An HP Apollo f8000 Rack or HP Apollo 8000 iCDU Rack supports up to approximately 2178 kg (4,800 lb) of static loads of equipment on the leveling feet and feet pads.

The figures below show the locations of the rack leveling feet. Ensure there is adequate floor and supporting understructure remaining to support the load-bearing leveling feet, especially immediately around the cutout. After the HP Apollo 8000 System is positioned in the proper location in the data center, it can be lowered into place with the leveling feet and leveling feet pads.

Rack leveling feet locations (top view of single rack)

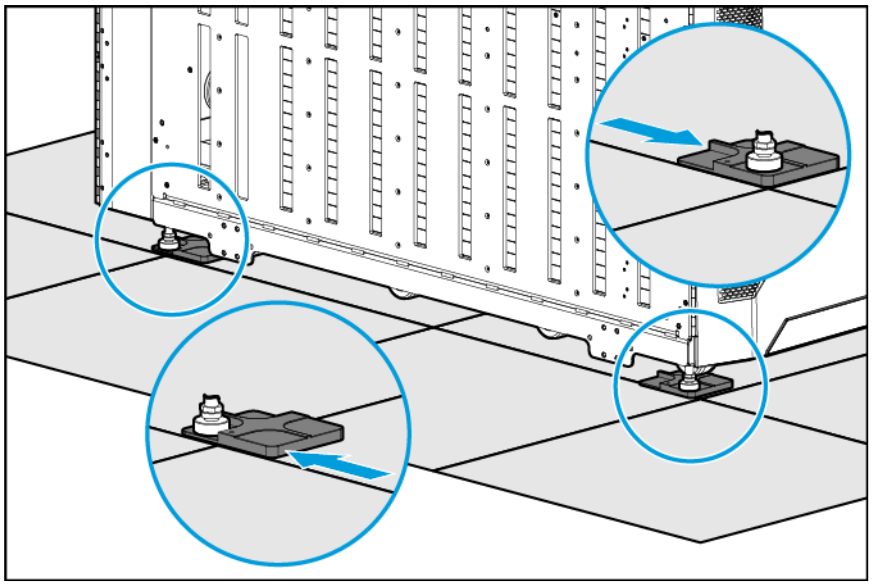


The leveling feet pads help to ensure weight distribution and help transfer the load to the support structure below the floor. You must ensure proper orientation of the feet pads so that subsequent racks can be properly accommodated.

To allow for proper water drainage flow, the front of the rack should be elevated at least 15.87 mm (0.625 in) higher than the rear of the rack. The leveling feet pads have two different heights, designed to ensure the proper elevation for drainage flow to the rear of the rack.

- Use the thick side of the leveling feet pads for the front of the rack.

- Use the thin side of the leveling feet pads for the rear of the rack.



Floor loading considerations

The computer room floor must be able to support the total weight of the installed server trays as well as the weight of the HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack as they are moved into position. The information presented in this section is about raised floor installations. HP cannot assume responsibility for determining the suitability of a particular raised floor system. The customer or local agencies should determine installation requirements. An appropriate structural engineer should verify any floor system under consideration for a server installation.

Raised floor loading is a function of the manufacturer's load specification and the positioning of the equipment relative to the raised floor grid. HP recommends the following guidelines:

- Some raised floor systems do not have grid stringers between floor stands. The lateral support for the floor stands depends on adjacent panels being in place. To avoid compromising this type of floor system while gaining under-floor access, remove only one floor panel at a time.
- Larger floor grids (bigger panels) are generally rated for lighter loads.
- An HP Apollo f8000 Rack or HP Apollo 8000 iCDU Rack supports up to approximately 2178 kg (4,800 lb) of static loads of equipment on the leveling feet and feet pads.

The HP Apollo 8000 System has not been certified for seismic environments.

HP Apollo f8000 Rack weight calculation

- Empty rack weight—1225 kg (2700 lb)
- Fully loaded rack weight—2585 kg (5700 lb)

HP Apollo 8000 iCDU Rack weight calculation

Component	Unit weight	Quantity (multiple by)	Total weight
HP Apollo 8000 iCDU Rack (with no hose kits or IT equipment installed)	896 kg (1974 lb)	1	896 kg (1974 lb)

Component	Unit weight	Quantity (multiple by)	Total weight
Component #1: Mellanox Infiniband switch*	212.2 kg (468 lb)	1	212.2 kg (468 lb)
Component #2:			
Component #3:			
Component #4:			
Rack Total:			

*Component #1 included as an example

Common floor-loading terms

Term	Description
Dead load	The weight rating for the load the floor can support expressed in kg/m² (lb/ft²)
Uniform load	The load that the floor system can safely support; expressed in kg/m² (lb/ft² or kN/m²)
Concentrated load*	The load that a floor panel can support on a 25 x 25 mm² (1 x 1 inches²) at the panels weakest point (typically the center of the panel), without the surface of the panel deflecting more than a predetermined amount
Rolling load	The load a floor panel can support (without failure) when a wheel of specified diameter and width is rolled across the panel

Example: Tate All Steel 1250 raised floor specifications

Item	Rating
Dead load	34.2 kg/m² (7 lb/ft²)
Uniform load	1,552 kg/m² (400 lb/ft²)
Concentrated load*	567 kg (1,250 lb)
Rolling load	227 kg (500 lb)

*With 2.54 mm (0.10 inch) of span maximum deflection

Electrical considerations

The electrical practices and suggestions in this guide are based on North American practices. For regions and areas outside North America, local electrical codes take precedence over North American electrical codes. An example would be the recommendation that the protective ground conductor should be green with yellow stripes. This requirement is a North American directive and does not override the local code requirements for a region or areas outside North America.

⚠ **WARNING:** To avoid personal injury and damage to the equipment, be sure that an emergency power shut off switch is in place and is easily accessible.

The HP Apollo f8000 Rack provides four AC input connections and ships with four power cords for connecting to three-phase AC power buses.

The HP Apollo 8000 iCDU Rack ships with one power cord for connecting to a three-phase AC power bus.

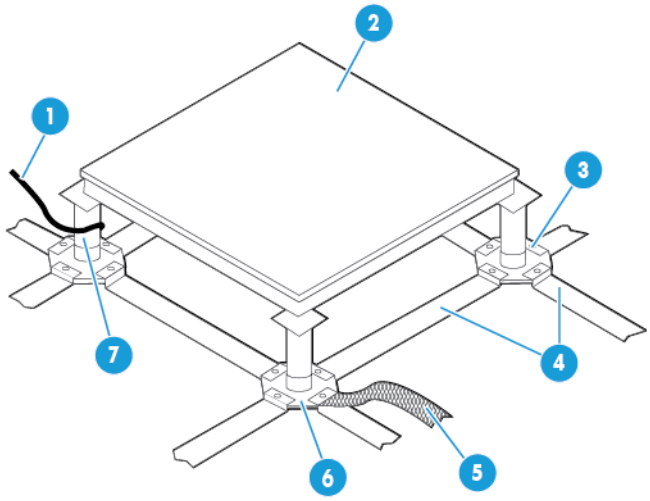
For more information, see "Connecting to facility A/C power (on page 21)."

System grounding

HP server systems require two methods of grounding: power distribution grounding for safety, and high-frequency signal grounding for equipment performance. Power distribution grounding involves the main building electrical service entrance, electrical conduit, facility power panels, and equipment cabinets (including the HP Apollo 8000 System), which should be grounded using green or yellow insulated wire conductors according to the applicable electrical codes. High-frequency grounding consists of using ground return conductors for intra- and inter-cabinet signal interconnects as well as chassis and cabinet grounding.

For the HP Apollo 8000 System and server systems installed on a raised floor, the floor assembly should be electrically grounded to form a complete ground grid. An optimum raised-floor grounding solution is shown in the figure below.

Each floor panel should have at least one supporting pedestal grounded to the power panel and another pedestal grounded to an equipment cabinet. This broadband solution provides excellent grounding for improved safety and performance.



Item	Description
1	Ground wire to power panel
2	Floor panel
3	Hex bolt
4	Grounding grid element
5	Grounding braid to computer equipment
6	Band and pedestal
7	Grounding clamp

Voltage fluctuations and outages

The HP Apollo 8000 System is designed to provide immunity to power outages of less than one cycle. However, testing cannot conclusively rule out loss of service. Therefore, adherence to the following guidelines provides the best possible performance of power distribution systems for HP equipment:

- Dedicated power source—Isolates the power distribution system from other circuits in the facility.

- Missing-phase and low-voltage detectors—Shuts equipment down automatically when a severe power disruption occurs. For peripheral equipment, these devices are recommended but optional.
- Online uninterruptible power supply—Maintains constant input voltage to devices and should be considered if outages of one-half cycle or more are common. Refer to qualified contractors or consultants for each situation.

The HP Apollo 8000 System can be protected from the sources of many electrical disturbances by using:

- An isolated power distribution system
- Power conditioning equipment
- Over- and under-voltage detection and protection circuits
- Protection to reduce high-frequency electrical energy radiation
- Surge protective devices on power cables to protect equipment against electrical storms

Electrical planning around water-handling components

△ **CAUTION:** In case water is in contact with the power cables, shut down the main breaker before cleaning up water in this area.

Because of potential condensation on non-insulated water connections or leaking water connections around water-based cooling systems, consider the following during the electrical planning:

- Waterproofed connectors
- Watertight conduits for cables
- Leak detection systems

To identify waterproofed connectors, HP recommends that you use the IP rating of the connector based on the international standard IEC 60529. HP recommends a connector that is rated at least IP 67.

Cable conduits are available in different styles, depending on flexibility and materials. The most common materials are plastic, metal, nylon, or a composition of these materials. Watertight conduits are available in both flexible and hard material, depending on the application.

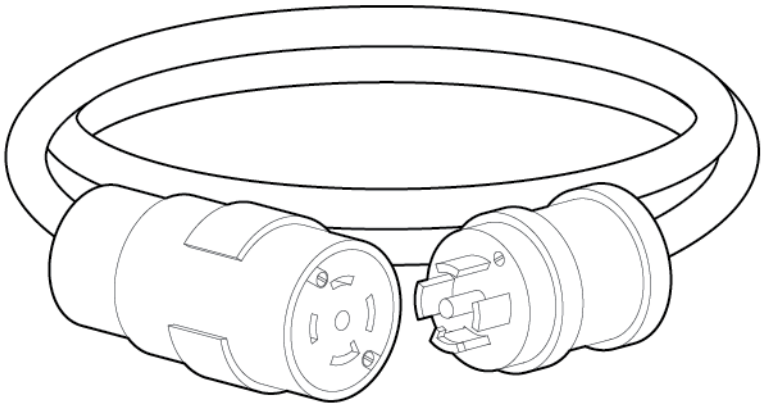
A leak detection system for a data center usually uses leak sensor cables, which are installed on the subfloor in a raised floor and connected to a facility management system.

Connecting to facility A/C power

The HP Apollo 8000 System accepts AC power through four three-phase power cords that are routed either up or down the back of the rack.

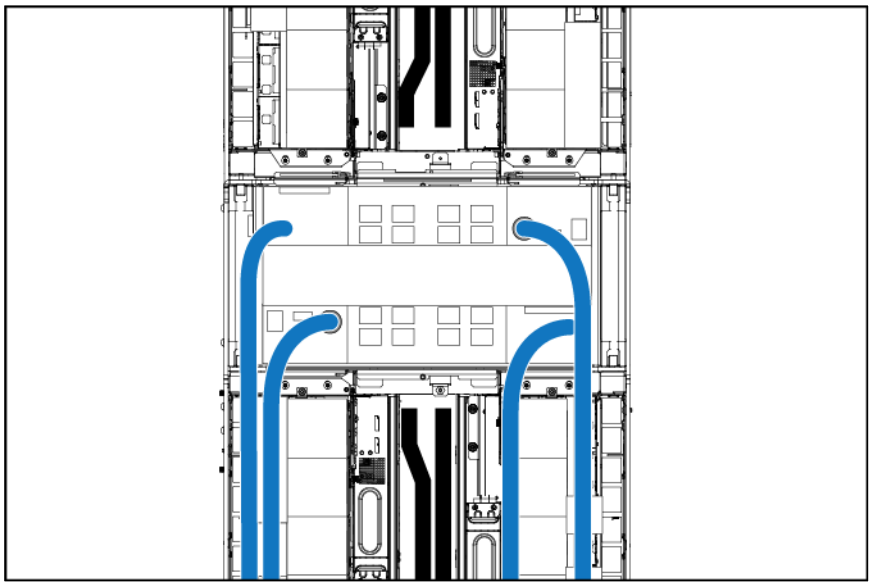
The figure below shows the two types of power cords shipped with the HP Apollo 8000 System. The NEMA L22-30P power cord on the left uses a NEMA L22-30P male plug for connecting to a facility AC feed connector common to North America and Japan. The IEC 60309-32 power cord on the right uses an IEC 60309-32 male plug for connecting to a facility AC feed connector common in various international regions.

HP Apollo 8000 System power cords



All four power cords must be used for operation of the HP Apollo 8000 System.

WARNING: The AF900A, AF901A and AF902A 415V model PDUs must only be used on 240/415V circuits. 240/415V 5W wye power systems are not standardized in North America and Japan and may be distributed using NEMA L22 receptacles normally intended for 277/480V systems. To reduce the risk of fire and electric shock, be certain to connect the 415V models only to a receptacle wired for 240/415V.



Coolant source planning

CAUTION: The minerals and chemicals typically found in tap water can react with metallic elements used in the HP Apollo 8000 System closed-loop distribution system. Electrochemical reactions can cause scaling, corrosion, leaks, and blockage, ultimately resulting in reduced efficiency of the cooling system and even damage.

A number of factors relating to a facility water distribution system must be considered during the site preparation process, including the following:

- Redundant water configurations
- Type of water source: shared water or dedicated facility water loop
- Maximum and minimum temperatures of the facility water plant, and target facility water temperature of dedicated loop based on the total required and planned cooling capacity

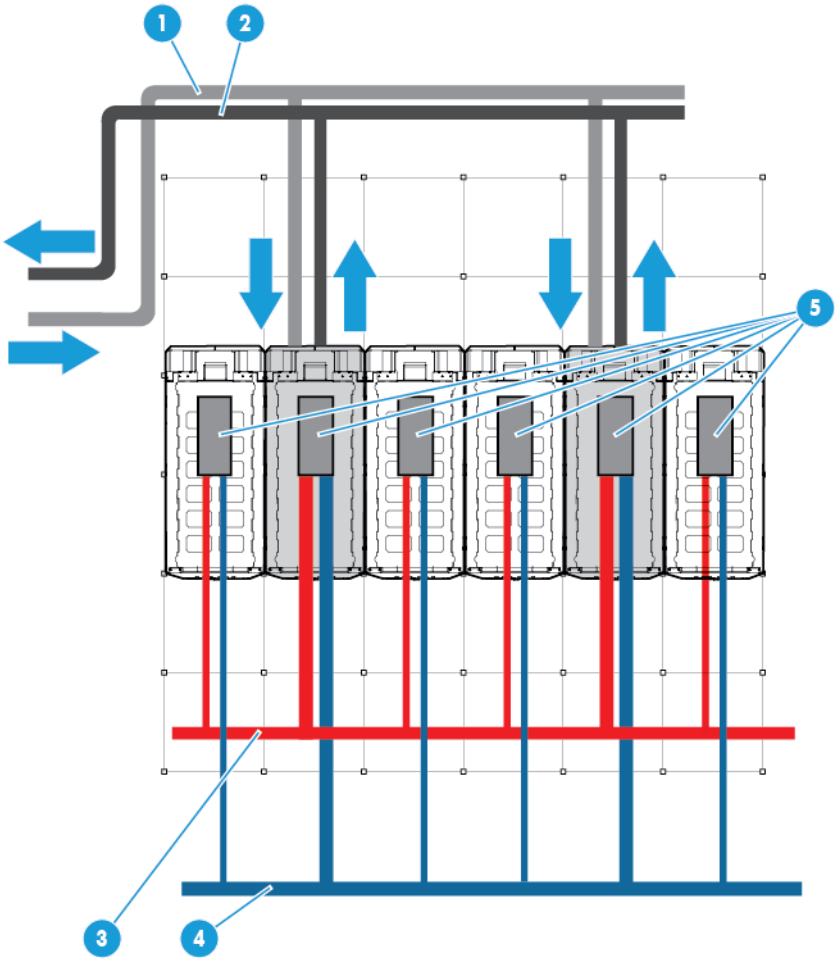
For information on water quality, temperature, and flow rate, see "Coolant requirements (on page 31)." Consult with a qualified facilities design expert to analyze new and existing systems and specify new work to ensure water quality, temperature, and water flow requirements can be met. The new work must meet all local safety and building code requirements as well as the customer's facility quality standards. Piping drawings and schematics included here are diagrammatic to convey a conceptual understanding of the HP Apollo 8000 System connection requirements.

Advantages of a dedicated secondary loop system

The water source for the HP Apollo f8000 Rack is an iCDU that allows for line isolation, better control of individual systems, and regulated water quality. Advantages in using a dedicated loop include:

- Easier scheduling of maintenance to either a building system or dedicated HP Apollo f8000 Rack loop
- Easier-to-maintain water quality parameters in the dedicated closed loop
- Better temperature and flow regulation to guarantee the needs of the HP Apollo f8000 Rack
- More flexibility to regulate water temperature in order to reduce the potential for condensation

The conceptual figure below depicts the HP Apollo f8000 Rack being supplied directly by a HP Apollo 8000 iCDU Rack in a closed loop configuration.



Item	Description
1	Facility water in
2	Facility water out
3	Secondary water out
4	Secondary water in
5	Heat exchanger

Plumbing considerations

It is essential that the rack and facility water inlet and warm water outlet hoses are connected properly.

The HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack plumbing kits can be ordered separately from the racks for early delivery for site preparation activities.

The following plumbing kits are available for order.

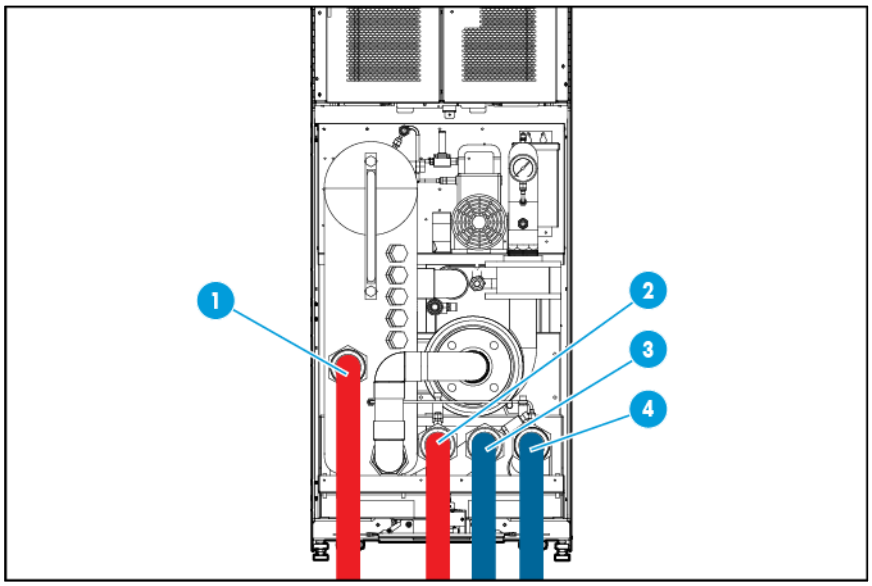
Plumbing Kit Name	HP Part Number	Description
HP Apollo f8000 Rack Plumbing Kit with Hose	J1P10A	Connects the HP Apollo f8000 Rack to secondary loop
HP Apollo 8000 iCDU Rack Plumbing Kit with Hose	J1P12A	Connects the HP Apollo 8000 iCDU Rack to facility water and to secondary loop
HP Apollo 8000 System Secondary Plumbing Kit	J1P14A	Connects the HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack in a secondary loop
HP Apollo 8000 System End Assembly Plumbing Kit	J1P15A	Used to seal water connections at the end of a row of HP Apollo f8000 Racks

Sample plumbing connections

The various plumbing kits allow the hoses to be routed either through the cutouts in a raised floor (recommended) or from above the racks.

For example, the right (blue) hose designates the facility water supplied to the HP Apollo 8000 iCDU Rack, and the left (red) hose is the warm water exiting from the HP Apollo 8000 iCDU Rack.

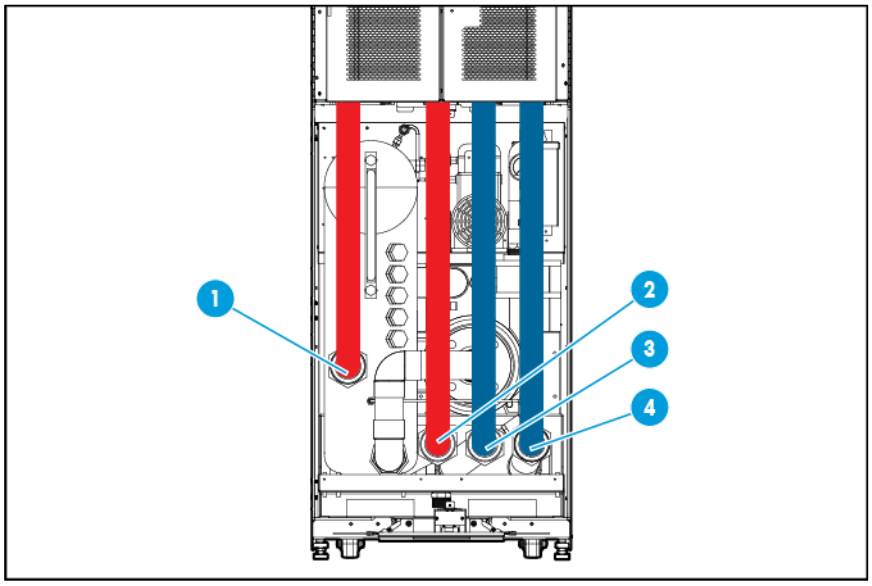
Underfloor connection



Item	Description
1	Secondary water in
2	Facility water out
3	Facility water in
4	Secondary water out

For underfloor installations, the preferred method of routing for all hoses is downward, without loops, and away from the HP Apollo 8000 iCDU Rack cabinet.

Overhead connection



Item	Description
1	Secondary water in
2	Facility water out
3	Facility water in
4	Secondary water out

Raised floor cutouts

A complete HP Apollo 8000 System installation typically requires the following floor cutouts for each rack in a raised-floor facility:

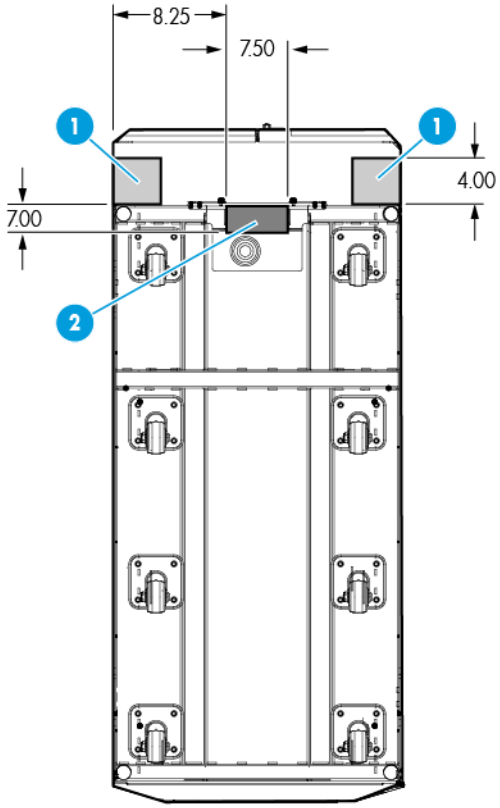
- One floor cutout for the water hoses, drain hoses, and power cords of the iCDU
- Floor cutouts for the power cords, data cables, water hoses, and drain hoses of the IT rack

Raised floor panels vary in size globally, but all create virtual grid lines or seams where panels come together. These seams are ideal for positioning computer racks on the raised floor.

Be sure that there is enough underfloor clearance for plumbing installation, approximately 616 mm (24.25 in) in height and 718 mm (28.27 in) in width.

The following figures reference the location of rack attributes aligned with raised floor seams to provide critical dimensions for floor cutouts. Exact cutout dimensions can vary depending on the facility. Be sure to work with your qualified engineer to validate the cutout locations and dimensions.

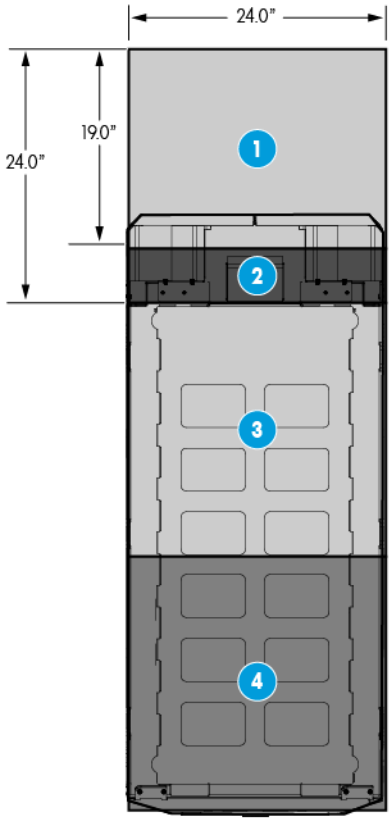
HP Apollo f8000 Rack floor cutout



Item	Description
1	Cutouts for power and signal cables
2	Cutout for plumbing and drain hoses

*These clearance values do not account for floor tile brush kits.

HP Apollo 8000 iCDU Rack floor cutout



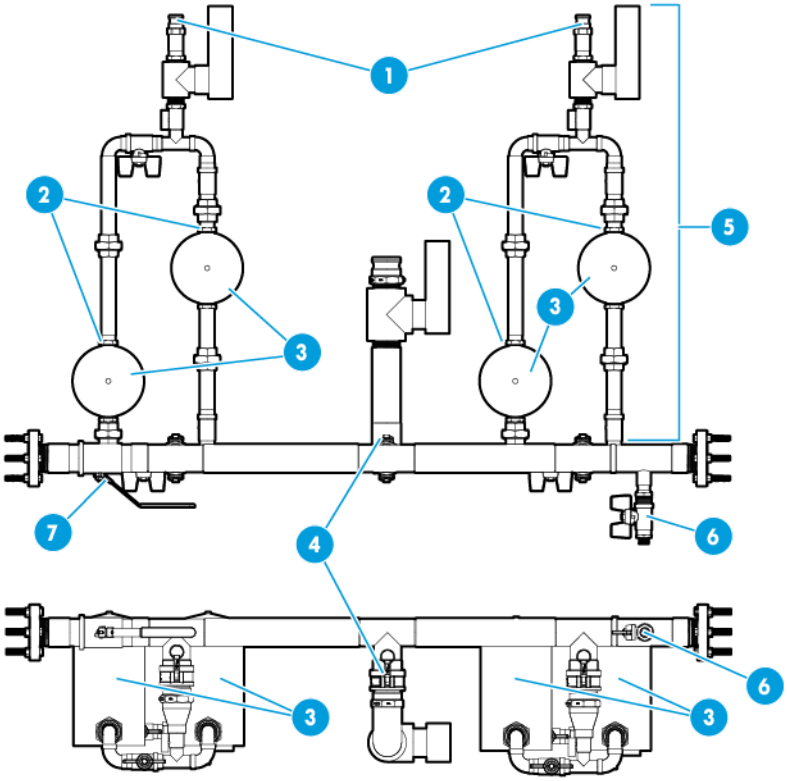
Item	Description
1	Cut tile
2	Cut area
3	iCDU tile
4	iCDU tile

Secondary water system components

The facility water supply and return service for each HP Apollo 8000 System are required to have a particular combination of components for peak performance.

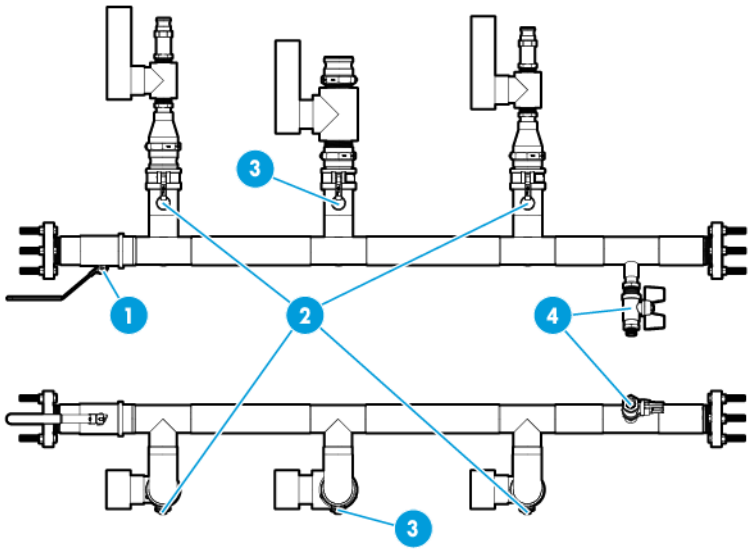
These components are identified in the following figures and tables.

Secondary water supply assembly - side view and top view



Item	Description
1	Isolation valve
2	Flow meter
3	Filter
4	Isolation valve—iCDU supply and return leg
5	Rack supply leg assembly
6	Manifold drain valve
7	Ball valve

Secondary water return assembly - side view and top view



Item	Description
1	Ball valve
2	Rack return leg assembly
3	Isolation valve—iCDU supply and return leg
4	Manifold drain valve

The supply and return assemblies are 1.8 m (6 ft) sections. Each section can accommodate up to three racks. The supply and return headers are 63.5 mm (2.5 in) type L copper pipes.

Typical plumbing installation guidelines

CAUTION: The water supply system feeding the HP Apollo 8000 System must be capable of withstanding operation with rapid and frequent changes in flow requirements.

Installation service for the HP Apollo f8000 Rack and iCDU is available for order.

- Plan for a 24–48 hour system cleaning window using water and pretreatment coolant suggested in this guide.
- Facility water connections should be within 3.05 m (10 ft) of the HP Apollo 8000 iCDU Rack.
- The facility water gravity drain must be within 3.5 m (11.48 ft) of the rack.
- Facility water connections should have a 63.5 mm (2.5 in) raised flange.
- Facility water differential pressure must be greater than or equal to 20 psid.
- HP shall install all valves, strainers, and other piping components. All components shall be readily accessible.
- HP shall flush all lines of debris and cap prior to HP Apollo 8000 System installation.
- Underfloor or overhead plumbing requires a minimum clearance of 616 mm (24.25 in) height and 718 mm (28.27 in) width.

IMPORTANT: The cross-sectional area where the plumbing is installed must be free from all obstructions.

- Secondary plumbing requires pipe hangers capable of supporting the following weights:
  - 6 foot supply line piping, including water-filled pipes and hoses weighing 143.35 kg (315.37 lbs)
  - 6 foot return line piping, including water-filled pipes and hoses weighing 96.37 kg (212.02 lbs)

  The rack supply leg must have additional support from a clevis hanger. Facility water hoses may require additional support.
- The appropriate plumbing kits must be ordered for each HP Apollo f8000 Rack and iCDU to be installed. For more information, see "Plumbing considerations (on page 24)."
- The facility must be able to accommodate a fluid drain system that connects the iCDU and HP Apollo f8000 Rack drains to the facility drain system.

For specific information on facility water and secondary loop water requirements, see "Coolant requirements (on page 31)."

Coolant requirements

General thermal requirements

The table below lists the coolant requirements that the facility must meet in order to support an HP Apollo 8000 System installation. In addition to the requirements listed, the coolant must meet the requirements prescribed in the section "Water quality requirements (on page 31)."

Parameter	Value
Facility water temperature • Minimum • Maximum	 4°C (39°F) 27°C (80°F)
Facility water differential pressure (minimum)	20 psid
Inlet/outlet water connections to HP Apollo 8000 System (quantity 2)	63.5 mm (2.5 in) raised flange For more information, see "Plumbing considerations (on page 24)."
Condensate discharge tubing HP Apollo f8000 Rack iCDU	 3.5 m (137.8 in) length 19.05 mm (0.75 in) inner diameter
Facility cooling capacity (Performance is affected by water temperature)	320 kW maximum per four rack configuration (80 kW per rack)

The HP Apollo 8000 System can adequately handle the heat load capacity if the facility water temperature range is 4°C (39°F) to 27°C (80°F) and the minimum facility water differential pressure is 20 psid.

The temperature of the primary cooling water leaving the CDU is normally 35°C (95°F) to 40°C (104°F) with inlet primary water of 20°C (68°F) to 27°C (80°F).

The primary flow can be calculated based on the facility inlet water temperature. Maximum load is 150 gpm per CDU at 320 kW. This is based on 25°C (77°F) in and 35°C (95°F) out. Most facilities will have much lower flow rates, as flow decreases and primary outlet temperature increases as the primary inlet temperature and rack load decreases. A typical data center with 21°C (70°F) primary water inlet temperature will be less than 80 gpm per 320 kW heat load.

Water quality requirements

CAUTION: Contaminated water can cause decreased cooling capacity or disruption in service. The water flowing into the HP Apollo f8000 Rack must meet the guidelines stated in this guide. Damage caused by contaminated water is not covered by the HP unit warranty.

IMPORTANT: For detailed chemical MSDS resources pertaining to water quality, contact your HP service representative.

Closed-loop water must not contain any lime scale deposits or loose debris. Reverse Osmosis (RO) water is required for the HP Apollo f8000 Rack cooling system. Filters must be used to remove free-floating particulates and be regularly maintained. It is necessary to periodically add new fresh water, while also removing some of the enriched water. HP recommends that particulate filtration be implemented into the dedicated water supply system that feeds each HP Apollo f8000 Rack.

Another consideration for water is the required set point. Temperatures near or below 0°C (32°F) mean that the facility water plant condenser is very close to or below the freezing point of the water. The minimum facility water temperature to be supplied to the iCDU is 4°C (39°F). This could cause a blockage and damage to the unit, so an additive such as glycol might be necessary to lower the freezing point. However, the heat transfer potential of the water is lower, so proper equipment capacity de-rating would need to be taken into account.

In a cooling loop, metallic materials in a pipe distribution network are in constant contact with recirculating liquid and can react with impurities to cause corrosion that can develop into leaks or form deposits that can develop into blockages.

The rate of galvanic corrosion depends on the electrical potential between the two dissimilar metals and the temperature of the liquid.

Chemical composition of water in the secondary closed loop system must adhere to strict guidelines set by HP. Only an HP representative using approved chemicals should analyze or treat secondary water. As part of your site preparation tasks, you must send your water for analysis.

Primary water to the HP Apollo 8000 iCDU Rack must have a 30 mesh strainer and follow the requirements below.

Parameter	**Range**
pH	7–9
Specific conductance, at 25°C, µmhos	<2,500
Sulfur, total, as SO4, ppm	<100
Chloride, as Cl, ppm	<50
Sulfide, as S, ppm	<10
Hardness, total, as CaCO3, ppm	<200
Iron, total as Fe, ppm	<3.0
Manganese, total, as Mn, ppm	<0.1
Bacteria	<1,000 CFU/ml
Residue on evaporation, ppm	<500
Turbidity, NTU	20

Facility space equipment recommendation

In order to facilitate proper handling and staging of chemicals for use in the HP Apollo 8000 System, the following equipment is recommended as a minimum for the existing facility:

- Eye wash station
- Chemical storage cabinet

IMPORTANT: For detailed chemical MSDS resources pertaining to water quality, contact your HP service representative.

- MSDS of chemicals readily available in the facility space
- Safety goggles
- Apron or lab coat
- Nitrile gloves
- Spill kit
- Shop Vacuum, or equivalent, capable of vacuuming small volumes of water

Each facility has its own specific safety requirements. Verify all required safety equipment with the facility environmental health and safety (EHS) manager.

Additional water precautions

During the installation of the HP Apollo 8000 System:

- Ensure that all foreign matter and particulates are flushed from the system prior to installing the water kits for the HP Apollo 8000 System.
- Evaluate the short- and long-term system requirements against available water capacity.
- Ensure your facility water loop is properly designed for liquid cooling systems and separate from the sanitary water systems within your building (for example, bathroom, sink, or drinking water).
- Make sure facility managers understand that additional load is being added to the building's facility's water supply. Be aware that the heat load being added might have an effect on other components being cooled by the facility water plant.

Environmental considerations

See individual component documentation for environmental temperature and humidity specifications and recommendations.

Before installing or running active components

CAUTION: If the HP Apollo 8000 iCDU Rack unit runs in manual mode for a period of time without an adequate heat load being generated by servers or other computing/networking devices, excess condensation could occur within the cabinet or system.

Prior to starting up any active components (servers, storage devices, and so on) mounted in the HP Apollo f8000 Rack, the following actions must be performed:

- Secondary loop cleaning procedure. This procedure should be performed by a qualified water quality agency or qualified HP service personnel who understands the water treatment process.
- Ensure the facility water source is on and flowing prior to the startup of the HP Apollo 8000 iCDU Rack and HP Apollo f8000 Rack.

- Make sure the HP Apollo f8000 Rack and iCDU is fully operational and running before turning on the servers and closing the front/rear cabinet doors.

Appendix A: Forms and checklists

Delivery survey form

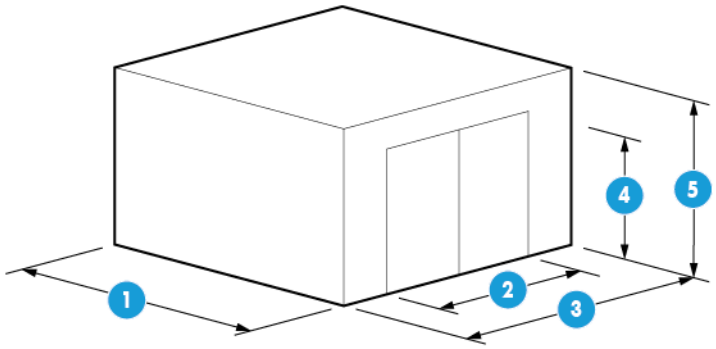
⚠ **WARNING:** To prevent possible serious personal injury or damage to equipment, do not move the HP Apollo 8000 System up or down stairs.

The delivery survey form lists delivery or installation requirements. If any of the items on the list apply, enter the appropriate information in the areas provided on the form. Special instructions or recommendations should be entered on a special instructions or recommendations form. The following list gives examples of special instructions or issues:

- Packaging restrictions at the facility, such as size and weight limitations
- Special delivery procedures
- Special equipment required for installation, such as tracking or hoists
- What time the facility is available for installation (after the equipment is unloaded)
- Special security requirements applicable to the facility, such as security clearance

Dock delivery	
Is the dock large enough for a semitrailer?	Yes or No
Location of the dock:	North, south, east, or west
Street name if different than company address:	
Street delivery	
Location of the access door:	North, south, east, or west
Street name if different than company address:	
Height of access door:	
Width of access door:	
Special permits (list type and agency obtained from):	
Hours of operation:	
Installation site	
Height of access door:	
Width of access door:	

If an elevator is required to move equipment, fill in the following information.



Item	Dimension	Measurement
1	Interior depth	
2	Door width	
3	Interior width	
4	Door height	
5	Interior height	
-	Elevator weight capacity	

Pre-installation checklists

Site preparation checklist

The tables below are site preparation checklists. For each item, check "yes" or "no" in the appropriate column.

If the answer is no, then include a comment or explanation and the date. An alternative solution might be required.

Facility considerations

Item	Area/condition	Yes	No	Comment/date
1	Is there adequate clearance from the loading area to the installation site to accommodate rack dimensions, including the pallet, if applicable?			
2	Is there a completed floor plan, including a detailed location of the HP Apollo 8000 System relative to the floor tile breaks and supports?			
3	Is there adequate space for maintenance needs? Recommended clearances are minimum 1,219 mm (48 inches) in front, minimum 914 mm (36 inches) in the rear.			
4	Is access to the site or computer room restricted?			
5	Is the computer room structurally complete? What is the expected date of completion?			
6	Is a raised floor installed and in good condition?			

Item	Area/condition	Yes	No	Comment/date
7	Is a raised floor system, including needed cutouts, able to adequately support the fully loaded rack and iCDU?			
8	Are there channels or cutouts for cable routing?			
9	Is there a network line available?			
10	Are floor tiles in good condition and properly braced?			
11	Is there a leak detector for the facility water system (external to the iCDU)?			
12	Are masonite boards available for floor protection during rack movement over carpets and thresholds?			

Power and lighting considerations

Item	Area/condition	Yes	No	Comment/date
1	Are there AC outlets available for servicing needs (for example, for laptop)?			
2	Does the input voltage correspond to HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack specifications?			
3	Is dual source power used? If so, identify types and evaluate grounding.			
4	Does the input frequency correspond to equipment specifications?			
5	Is power conditioning equipment installed?			
6	Is there a dedicated branch circuit for equipment?			
7	Is there a dedicated branch circuit less than 22.86 m (75 ft) away?			
8	Are the input circuit breakers sized to protect their respective receptacles for equipment loads?			

Safety considerations

Item	Area/condition	Yes	No	Comment/date
1	Is there an emergency power shutoff switch?			
2	Is there a telephone available for emergency purposes?			
3	Is there a fire protection system in the computer room?			
4	Is antistatic flooring installed?			

Water preparation considerations

Item	Area/condition	Yes	No	Comment/date
1	Has the water been tested for acceptable quality for use in the HP Apollo 8000 System?			
2	If the water quality is unacceptable, have adequate treatment filtration measures been put in place?			
3	Have the water temperature and flow been evaluated?			
4	Has piping of an appropriate diameter, material, and pressure tolerance been installed to reach the back of each HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack?			

Item	Area/condition	Yes	No	Comment/date
5	Is there a provision for fluid collected from the condensation and overflow hoses at each HP Apollo f8000 Rack and HP Apollo 8000 iCDU Rack?			
6	Is there dedicated cabinet space for storage of water quality chemicals and gloves?			
7	Is there an available space to prepare and handle chemicals before adding them to the system?			
8	Is Nalprep 8349 (commercially available from Nalco Company) available on site for the secondary loop cleaning procedure?			
9	Has the approximate volume of water in the entire system been determined? (Necessary for water chemical preparation)			
10	Have the water treatment chemicals been evaluated and approved through your facility EHS department?			

Appendix B: Conversion factors and formulas

Conversion factors and formulas

The conversion factors provided in this appendix are intended to ease data calculation for systems that do not provide information in the format requested in this site preparation guide. The following list includes the conversion factors used in this document, as well as additional conversion factors that might be helpful in determining those factors required for site planning.

Conversion factors for refrigeration

- 1 watt = 0.86 kcal/hour
- 1 watt = 3.412 British thermal unit (BTU)/hour
- 1 ton = 200 BTU/minute
- 1 ton = 12,000 BTU/hour
- 1 ton = 3,517.2 W

Metric equivalents

- 1 centimeter = 0.3937 inches
- 1 meter = 3.28 feet
- 1 meter = 1.09 yards
- 1 inch = 2.54 centimeters
- 1 foot = 0.305 meters
- 1 cubic foot/minute = 1.7 cubic meters/hour

kVa conversions

- Three-phase kilovolt-amperes (kVA) = V x A x √3/1,000
- Single-phase kVA = V x A/1,000

Formulas

- kVA = [Voltage x Current (amps)]/1,000
- Watts = VA x power factor
- BTU = Watts x 3.41

Regulatory information

Safety and regulatory compliance

For safety, environmental, and regulatory information, see *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at the HP website (http://www.hp.com/support/Safety-Compliance-EnterpriseProducts).

Turkey RoHS material content declaration

Türkiye Cumhuriyeti: EEE Yönetmeliğine Uygundur

Ukraine RoHS material content declaration

Обладнання відповідає вимогам Технічного регламенту щодо обмеження використання деяких небезпечних речовин в електричному та електронному обладнанні, затвердженого постановою Кабінету Міністрів України від 3 грудня 2008 № 1057

Warranty information

HP ProLiant and X86 Servers and Options (http://www.hp.com/support/ProLiantServers-Warranties)

HP Enterprise Servers (http://www.hp.com/support/EnterpriseServers-Warranties)

HP Storage Products (http://www.hp.com/support/Storage-Warranties)

HP Networking Products (http://www.hp.com/support/Networking-Warranties)

Regulatory requirements for EXIT signs

Manufacturers of tritium EXIT signs are “specific licensees,” meaning they are licensed by the NRC or an Agreement State. The signs are considered “generally licensed devices,” because they are inherently safe enough to be handled or used by anyone with no radiation training or experience. Although purchasers – known as “general licensees” – do not need authorization from the NRC or a state regulatory agency to possess the signs, they are subject to certain regulatory requirements regarding handling, transfer or disposal of the signs. For more information, see the NRC website (http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-tritium.html#_edn2). They are also subject to NRC or Agreement State inspection and enforcement action (including fines) for violating those requirements. Manufacturers must inform purchasers of the EXIT signs of the regulatory requirements for generally licensed devices. The general licensee is required to designate an individual responsible for complying with the regulatory requirements.

Under NRC regulations, a general licensee using tritium EXIT signs:

- must NOT remove the labeling or radioactive symbol, or abandon a sign;
- must properly dispose of an unused sign (see below);
- must report to the NRC or the appropriate Agreement State any lost, stolen or broken signs;
- must inform the NRC or an Agreement State of a name change, change of address or replacement of a general licensee's designated representative;
- must NOT give away or sell the sign to another individual, company or institution unless the device is to remain in use at its original intended location; in such a case, the transferor is to notify the recipient of the regulatory requirements and must notify the NRC or Agreement State of the transfer within 30 days.

Tritium EXIT signs must NOT be disposed of as normal trash. To dispose of a sign properly, a general licensee must transfer the sign to a specific licensee. This would typically be a manufacturer, distributor, licensed radioactive waste broker, or a licensed low-level radioactive waste disposal facility. These facilities may charge a fee for this service.

Within 30 days of disposing of a sign, the general licensee is required to file a report to the NRC or Agreement State that includes:

- the device manufacturer's (or distributor's) name, model number and serial number;
- the name, address, and license number of the person receiving the device; and
- the date of the transfer.

Reports should be sent to Director, Office of Federal and State Materials and Environmental Management Programs, ATTN: GLTS, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

For more information, see the Fact Sheet on Tritium EXIT Signs on the NRC website (http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-tritium.html).

Support and other resources

Before you contact HP

Be sure to have the following information available before you call HP:

- Active Health System log (HP ProLiant Gen8 or later products)

  Download and have available an Active Health System log for 3 days before the failure was detected. For more information, see the *HP iLO 4 User Guide* or *HP Intelligent Provisioning User Guide* on the HP website (http://www.hp.com/go/ilo/docs).

- Onboard Administrator SHOW ALL report (for HP BladeSystem products only)

  For more information on obtaining the Onboard Administrator SHOW ALL report, see the HP website (http://www.hp.com/go/OAlog).

- Technical support registration number (if applicable)
- Product serial number
- Product model name and number
- Product identification number
- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level

HP contact information

For United States and worldwide contact information, see the Contact HP website (http://www.hp.com/go/assistance).

In the United States:

- To contact HP by phone, call 1-800-334-5144. For continuous quality improvement, calls may be recorded or monitored.
- If you have purchased a Care Pack (service upgrade), see the Support & Drivers website (http://www8.hp.com/us/en/support-drivers.html). If the problem cannot be resolved at the website, call 1-800-633-3600. For more information about Care Packs, see the HP website (http://pro-aq-sama.houston.hp.com/services/cache/10950-0-0-225-121.html).

Glossary

apparent power

A value of power for AC circuits that is calculated as the product of RMS current times RMS voltage, without taking the power factor into account.

ASL

Above Sea Level

BSPP

british standard pipe parallel

BTU/h

The abbreviation for British thermal units per hour. The amount of heat required to raise one pound of water one degree Fahrenheit per hour, a common measure of heat transfer rate.

CFM

The abbreviation for cubic feet per minute, commonly used to measure the rate of air flow in an air conditioning system.

CTO

configure to order

derate

To lower the rated capability of an electrical or mechanical apparatus.

FRU

field replaceable unit

heat exchanger

Cooling unit that maintains two separate environments inside and outside the cabinet or room. It can be either a water-to-water, water-to-air, or air-to-air configuration, in either direction.

HEX

heat exchanger

inrush current

The peak current flowing into a power supply the instant AC power is applied to. This peak is usually much higher than the typical input current because of the charging of the input filter capacitors. When switching

power supplies are first turned on, they present high initial currents as a result of filter capacitor independence. These large filter capacitors act like a short circuit, producing an immediate inrush surge current with a fast rise time. The peak inrush can be several orders of magnitude greater than the supply's typical current.

LAHJ

local authority has jurisdiction

leakage current

A term relating to current flowing between the AC supply wires and earth ground. The term does not necessarily denote a fault condition. In power supplies, leakage current usually refers to the 60 Hz current, which flows through the EMI filter capacitors that are connected between the AC lines and ground.

maximum input current

The operating current of the product equal to the maximum load divided by the minimum input voltage.

power factor

The ratio of true power (watts) to apparent power (VA) in an AC circuit. In power conversion technology, the power factor is used in conjunction with describing the AC input current to the power supply.

RMS

Root-mean-square (RMS) refers to the most common mathematical method of defining the effective voltage current of an AC wave. To determine RMS value, three mathematical operations are carried out on the function representing the AC waveform: 1) The square of the waveform function (usually a sine wave) is determined. 2) The function resulting from step 1 is averaged over time. 3) The square root of the function resulting from step 2 is found.

theoretical maximum power consumption

Maximum wattage of a given configuration, assuming worst-case conditions (thermal tolerances, workloads, and so forth) on all system components. It is extremely unlikely that any customer will experience this level of power consumption.

true power

In an AC circuit, true power is the actual power consumed and is measured in watts. It is distinguished from apparent power by eliminating the reactive power component that may be present.

typical input current

The operating current of the product measured using a typical load and target voltage.

typical power consumption

Represents the expected power consumption of a given configuration. The typical value is the approximate power consumption that a customer will most likely experience and can use for power budgeting purposes.

watt

A unit of electricity consumption representing the product of amperage and voltage. When the power requirement of a product is listed in watts, you can convert to amps by dividing the wattage by the voltage (for example, 1200 W divided by 120 V is 10 A).

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